BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 32-1063

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Civil Engineering

ELECTRIC POWER SYSTEMS

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

OPR: HQ AFCESA/ENE
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This instruction implements AFPD 32-10, *Installations and Facilities*, by assigning responsibilities for providing, operating, maintaining, and accounting for electrical power and other selected electrical systems. Send recommendations for changes or improvements to this publication on AF Form 847, **Recommendation for Change of Publication**, through major commands (MAJCOM) and HQ AFCESA/ENM, 139 Barnes Drive, Tyndall AFB FL 32403-5319 to HQ USAF/CEO, 1260 Air Force Pentagon, Washington DC 20330-1260. **Attachment 1** lists the references, abbreviations, acronyms, and terms used.

SUMMARY OF REVISIONS

This is the initial publication of AFI 32-1063, which revises AFR 91-4. It clarifies real property reconciliation after generator inventory (paragraph 1.1.7); explains accounting for real property installed equipment (RPIE) generators (paragraph **3.1.**); adds procedures to ensure generators are at least 25 percent loaded (paragraph **4.**); and adds a requirement to develop maintenance schedules using National Fire Protection Agency (NFPA) 70B (paragraph **7.**).

1. Responsibilities. The Base Civil Engineer (BCE):

1.1. Provides, operates, and maintains all real property electrical power systems and equipment. Operates and maintains equipment authorization inventory data (EAID) equipment assigned to the BCE. This includes operating and maintaining real property installed equipment (RPIE) items except units supporting missile systems.

1.2. Provides and maintains other real property and RPIE electrical systems such as:

- Water level or pressure alarms--tanks and reservoirs.
- Master and individual clock systems (general use facility types).
- Master TV antennas.

- Annunciator systems.
- Audio alarms.
- Systems for utility plant management and distribution, such as energy management and control systems (EMCS) and supervisory control and data acquisition systems (SCADA).
- Power filter systems.

1.3. Installs and maintains the electrical distribution system for 400 Hz generators not installed on equipment. Users are responsible for 400 Hz generators installed on equipment.

1.4. Ensures EAID or RPIE generators do not tie into, transfer power to, or synchronize with any real property electrical system (transformer, switch gear, or utility) unless authorized by the BCE.

1.5. Services special use facilities and Power Conditioning and Continuation Interfacing Equipment (PCCIE) as described in paragraph **2.1.** and paragraph **2.2.**

1.6. Maintains current records of equipment operation, maintenance, repair, and replacement.

1.7. Conducts an inventory of all emergency generators each year and sends a copy to the MAJCOM. Reconciles inventory results with real property records for RPIE generator accountability, or with custodian authorization and custody receipt listing (CA/CRL) records for EAID generators. (Refer to paragraph **3.1.**) Includes the following data for each generator in the inventory:

- Location (building number of grid coordinates).
- Capacity in kilowatts (kW).
- Voltage.
- Single- or three-phase.
- Type of fuel (diesel or gasoline).
- Manufacturer
- Fuel tank above or below ground and size.
- Run time on full tank.
- Serial and stock numbers.
- Year manufactured.
- Proper account listing (RPIE or EAID).
- Maximum demand load.

1.8. Maintains these items current and accurate:

- Electrical power system capability studies.
- Record drawings.
- Facility schematics.
- Connection diagrams.
- One-line diagrams.
- As-built drawings depicting electrical power system equipment.
- Operation and maintenance manuals.

Develop these documents, if necessary.

1.9. Adheres strictly to special accountability requirements for generators in **3.**paragraph 3.

1.10. Trains users annually or more often, as required. Training includes procedures required for safe operation of electrical power systems. Verifies training and ensures only properly trained personnel operate the electrical system.

1.11. Maintains electrical power generating systems at special use facilities under the operational control of others only as defined in the applicable support agreement.

1.12. Develops an agreement for each special use facility. The agreement will state:

- The user organization operates and performs operator-level maintenance for all emergency power plants supplying electrical power exclusively to these facilities.
- The BCE performs the intermediate level maintenance and arranges for depot level maintenance on equipment, and may assist with operator level maintenance on an as-required reimbursable basis.
- The BCE retains the real property accountability for the generating units that supply emergency power exclusively to these facilities.

1.13. May support installation and maintenance of electrical power systems, fire protection systems, intrusion detection systems, and electrical heating and air-conditioning systems of equipment similar to RPIE. Include systems temporarily deployed during exercises, or contingency or wartime operations, or systems permanently assigned to an installation.

1.14. Assumes operations and maintenance (O&M) responsibilities for other user organization's electrical systems when all other parties agree. Negotiate such agreements only if they cut costs and improve support. Document them as memorandums of agreement or host-tenant support agreements, and prescribe support on a reimbursable basis, if appropriate.

2. Power Conditioning and Continuation Interfacing Equipment (PCCIE). PCCIE is classified as EAID equipment. Contact the PCCIE Program Manager at Sacramento Air Logistics Center (SM-ALC/LIET), McClellan AFB CA 95652-5000 for guidance on acquisition and maintenance of that equipment.

2.1. Include PCCIE in mission equipment acquisitions when it is needed to accomplish that mission. The purchasing organization initiates action to place an item on the table of allowance (TA) of the equipment served. When the equipment requires installation support, include it in the purchasing agreement. Otherwise, charge installation expenses to O&M funds.

2.2. Include PCCIE maintenance with the mission equipment it serves. If this is not possible and the BCE has the capability, he may maintain PCCIE if reimbursed for time and material.

3. Accounting for Generators. Account for all generators either as RPIE or EAID

3.1. Real Property Installed Equipment (RPIE). List any generator installed in a facility on the Real Property Record as RPIE. Notify the real property office if these generators are temporarily relocated from one facility to another. Account for RPIE generators awaiting installation in the appropriate work order documents. For excess generators, ask the MAJCOM for review and disposition instructions before removing the generator from a RPIE facility. After removing a generator, account for it on DD Form 1149, **Requisition and Invoice/Shipping Document**, if you ship it to another base; or on DD Form 1348-1, **DoD Single Line Item Release/Receipt Document**, if you turn it in to

Defense Reutilization and Marketing Office (DRMO). MAJCOMs report excess generators larger than 200 kW to HQ AFCESA/DMC. Discontinue reporting during emergency conditions.

3.2. Equipment Authorization Inventory Data (EAID). Generating units listed in Tables of Allowances and requisitioned from SM-ALC/LIET are EAID and accounted for by Base Supply. The initial requirement, or the method of obtaining a generator, does not determine its accounting classification. Only a generator that is an essential component of an electrical power system is RPIE. Reclassify an EAID unit that meets the RPIE definition, or turn it into Base Supply. When reclassifying a generator, coordinate with the Item Manager (SM-ALC/LIET). Also report excess EAID generators through channels to SM-ALC/LIET.

4. Validating Existing Emergency Generators. Review all AF Forms 487, **Emergency Generator Operating Log**, at least annually to verify generators and associated equipment are adequate and reliable. Replace generators carrying a load less than 25 percent capacity with a smaller generator, when one becomes available. When AF Form 487 does not provide a generator's true load, use alternative data--such as clamp-on ammeter readings, building and equipment wiring schematics, and equipment power consumption data--to determine if the generator's load is too small.

5. Facilities Authorized Emergency Power. The Air Force authorizes use of emergency generators and related wiring systems when needed to support certain essential functions, per MIL-HNBK-1190B, *Facility Planning and Design Guide*:

- Medical treatment facilities.
- Air navigation aids and facilities.
- Refrigerated storage rooms.
- Petroleum, oil, and lubricant (POL) storage and dispensing facilities.
- Critical utility plants and systems.
- Civil engineer control centers.
- Communication facilities and telephone exchanges.
- Fire stations, including fire alarm, fire control, and radio equipment.
- Critical computer automatic data processing facilities.
- Air traffic control towers.
- Base weather stations.
- Surveillance and warning facilities.
- Command and control facilities.
- Weapon systems.
- Security lighting systems.
- Aircraft and aircrew alert facilities.
- Law enforcement and security facilities.
- Disaster preparedness control center.
- Mission, property, and life support facilities at remote and not readily accessible sites, such as split-site aircraft warning and surveillance installations.

- One feeding facility per installation (MAJCOM may approve additional facilities)
- Industrial facilities that have noxious fumes requiring removal. Provide power for exhaust system only.
- Readiness facilities relying on electrical power to support tactical or critical missions (requires MAJCOM approval).
- Photographic laboratories providing critical and essential support to combat and contingency tactical missions.

6. Applicable Codes. The codes listed in **Attachment 1** and host-nation codes apply.

7. Maintaining, Testing and Exercising Electrical Systems. Develop and maintain schedules and procedures for maintaining, exercising and testing electrical systems. Follow the recommendations in NFPA 70B, *Electrical Equipment Maintenance,* unless local conditions or operations justify variations.

7.1. Engine Generators. Do not test generator sets under no-load conditions. Test emergency power generating systems with the actual load connected. Also, do not test with a load bank except when required to support a specific maintenance action. Use procedures that duplicate conditions during a nonscheduled power outage. If the electrical power demand load is under 25 percent and a smaller generator is not available, procure sacrificial loadbanks as outlined in the technical order. Balance load on the phases for three-phase generators.

7.1.1. Unless otherwise specified, exercise engine driven generator sets each month for 1-continuous hour after the unit reaches operating temperature.

7.1.2. Exercise emergency systems supporting navigational aids for air traffic control facilities according to this instruction and AFI 13-203, *Air Traffic Control* (formerly AFR 60-5).

7.1.3. Exercise emergency power systems supporting Defense Communications Systems (DCS) or related communications activities according to Defense Information Systems Agency (DISA) Circular 350-195-2, *Exercise of Auxiliary Electric Power Systems*.

7.1.4. Exercise emergency power systems that support composite medical facilities according to NFPA 99, *Health Care Facilities*.

7.2. EAID Generators. Exercise EAID generators stored and ready for emergency use according to this instruction. Use a load bank or connect the generator to a facility or system. Annually, exercise the unit while it is connected to the facility or system it primarily supports. Facilities served by these units must have a quick disconnect switch installed in sight of the unit.

7.3. Other Engine-Driven Equipment. Exercise gasoline engine-driven motors for 30 minutes every month.

7.4. Transfer Switch. Test transfer switches according to manufacturer's instructions. At critical electronic facilities, use the synchronized closed transition or maintenance bypass feature to prevent power interruption during generator testing.

7.5. Grounding Systems. At major communications and electronics facilities, test the building ground system every 21 months. The user inspects, maintains, and repairs the in-house electronic equipment ground system. See AFI 32-1065, *Grounding Systems* (formerly AFR 91-43) for more guidance and requirements at other facilities.

7.6. Control Systems. Test all electrical fire detection, notification, and extinguishing systems according to AFI 32-2001, *Fire Protection* (formerly AFR 92-1). Test other signal and call systems at least once every 2 years.

7.7. Protective Relays. Record operations (flags) of all power systems protective relays in a log book used for this purpose. Keep this log as close to the relay as possible, preferably inside the breaker cubicle. Record the date, which relay operated (phase A, B, C, or ground overcurrent), whether the trip was timed or instantaneous, and whether any reclosing relay operated to close out. These data are extremely useful for troubleshooting power system (feeder or generator) problems and for projecting corrective actions and upgrades.

JAMES E. McCARTHY, Maj General, USAF
The Civil Engineer

Attachment 1

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

References

AFI 13-203, *Air Traffic Contro*l (formerly AFR 60-5*)*

AFI 31-101, *Air Force Physical Security Program* (formerly AFRs 207-1, 207-2, 207-4, 207-5, 207-6, 207-7, 207-8, 207-21, and 207-23)

AFI 32-1062 , *Management of Electrical Power Plants and Generators* (formerly AFR 91-45)

AFI 32-1064, *Electrical Safe Practices* (formerly AFR 91-12)

AFI 32-1065, *Grounding Systems* (formerly AFR 91-43)

AFI 32-2001, *Fire Protection* (formerly AFR 92-1)

AFM 88-9, Chapter 1, *Electrical Power Supply and Distribution*

AFM 88-9, Chapter 2, *Electrical Design, Interior Electrical Systems*

AFM 88-9, Chapter 3, *Electrical Design, Lightning and Static Electricity Protection*

AFIND 17, *Air Force Occupational Safety and Health (AFOSH) Standards Department of Labor Occupational Safety and Health (OSHA) Standards, and National Institute for Occupational Safety and Health (NIOSH) Publications* (formerly AFR 0-17)

MIL-HNBK-1190B, *Facility Planning and Design Guide*

DISA Circular 350-195-2, *Exercise of Auxiliary Electric Power Systems*

ANSI C2, *National Electrical Safety Code (NESC).* (Copies available from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York NY 10017-5000.)

ANSI C84.1, *American National Standard for Electrical Power Systems and Equipment Voltage Ratings (60 Hz).* (Copies available from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York NY 10017-5000.)

NEMA MG-1, *Motors and Generators.* (Copies available from the National Electrical Manufacturer's Association, 2101 L Street NW., Washington DC 20017-5000.)

*NFPA 70, *National Electrical Code (NEC)*

*NFPA 70B, *Electrical Equipment Maintenance*

*NFPA 99, *Health Care Facilities*

* Copies available from the National Fire Protection Association, 1 Batterymarch Park, Quincy MA 02269-9990.

Abbreviations and Acronyms

ANSI—American National Standards Institute

BCE—Base Civil Engineer

CA/CRL—Custodian Authorization and Custody Receipt Listing

DCS—Defense Communications System

DRMO—Defense Reutilization and Marketing Office

EAID—Equipment Authorization Inventory Data

EMCS—Energy Management And Control Systems

MAJCOM—Major Command

NEC—National Electrical Code

NEMA—National Electrical Manufacturers Association

NESC—National Electrical Safety Code

NFPA—National Fire Protection Association

O&M—Operations and Maintenance

OSHA—Occupational Safety and Health Administration

PCCIE—Power Conditioning And Continuation Interfacing Equipment

RPIE—Real Property Installed Equipment

SCADA—Supervisory Control And Data Acquisition Systems

SMALC—Sacramento Air Logistics Center

TA—Table of Allowance

Terms

DepotLevel Maintenance—Maintenance work on power systems and equipment performed or directed by personnel in a civil engineer organization. It supports and supplements local (on site, organizational, and intermediate) levels of maintenance and includes:

- Providing technical and professional help to equipment operators and maintenance personnel.
- Operating a repair facility and maintaining stock of serviceable parts, components, equipments, and assemblies needed to perform all levels of maintenance.
- Performing major inspection and major overhaul of equipment (for example, rebuilding or manufacturing parts), reassembling system components, and testing.

Equipment Authorization Inventory Data (EAID) Equipment—Organizational equipment as described in AFM 671, Volume IV, Part One, *Air Force Equipment System Policy and Procedures.*

Intermediate Level Maintenance—Maintenance work done by personnel of an organization that may, or may not, be responsible for equipment operation. This level of maintenance is more complex than (and directly supports) organizational maintenance. It includes:

- Major inspection of power systems and equipment.
- Repairing or replacing minor components and assemblies of systems and equipment.
- Routine testing and calibration of system control equipment and allied components.
- Local manufacture of parts when needed but not available through normal supply channels.

OrganizationalLevel Maintenance—Maintenance work performed by personnel of an organization

responsible for equipment operation. This level of maintenance includes routine inspection, servicing, minor repairs, and adjustments.

Real Property Installed Equipment (RPIE)—In this instruction, RPIE is electrical equipment that aids real property functions. RPIE is permanently attached to, installed into, and builtin or on governmentowned orleased real property. How this equipment mounts (on wheels or stationary foundation) is not significant in RPIE classifications. Coordinate with the major command when an item accountability is in doubt.

Special Use Facility—A special use facility is built specifically for a high priority mission and is usually suitable only for that mission. These facilities often are not funded or budgeted through normal military construction channels, and frequently are acquired through equipment funds as part of a new mission beddown package. Examples are satellite communication systems and phased array radar systems.